

# CLEARING TROUBLED Waters

*Parts of the Fifth District are taking the advice of economists and using markets to help clean waterways*

BY BETTY JOYCE NASH

It's Indian summer out here on a cornfield ripe for harvest in a chunk of Virginia's coastal plain wedged between the sprawl of Richmond and Norfolk. Dubbed the "good luck tract" as a joke because of its erodible soil and 10 percent slope, the land may prove its worth in a new way.

Agriculture experts Jim Wallace and Brian Noyes from the Colonial Soil and Water Conservation District show off the "good luck tract" and its farmer, David Black. They advertise "continuous no till," or letting the land be, rather than plowing it before planting. After 12 years without tilling, the soil of the good luck tract stays put. Its biologically rich soil (packed with hard-working earthworms) holds its own in a hard rain and traps chemicals that foul waters to boot. Wallace, Noyes, and Black watch the progress of Black's father on the combine harvesting corn and joke that maybe they should pump the entire James River through the field to clean it up.

The good luck's arrested erosion is mighty good news for the James and feeder streams because heavy rains can wash sediment laden with "nutrients"—excess nitrogen and phosphorous (fer-

tilizer)—into rivers and streams. That pollution winds up in the Chesapeake Bay and beyond. Ultimately this overfeeds plant life and chokes off oxygen crucial to a healthy population of creatures. Such runoff is literally killing the bay and is responsible for dead zones in 13 of the nation's 17 most choked bays.

Some policymakers think the power of markets can help cleanse the nation's waterways of nutrient pollution. Market-like trading has been touted as a cheaper way to stimulate pollution prevention and speed compliance. The Environmental Protection Agency in 2003 published guidelines for nutrient trading, which gave the idea official support. EPA even threw in funding for pilot projects. The Clean Water Act's legal limits known as total maximum daily loads, TMDLs, are under development for polluted waters. Those load limits, for the first time, would set caps for pollution in waterways and allocate discharges that could be bought and sold.

That's part of what's motivating farmers, environmentalists, policymakers, industrial users, and municipalities to think creatively. Pollution enters waterways from point sources, wastewater treatment plants, and nonpoint

sources, urban and agricultural runoff. Nonpoint sources are tough to involve in a trading scheme even though runoff dirties water considerably. A trading plan might allow a farmer like David Black to put his carefully nurtured soil to work, says Jim Wallace.

"Luckily for us, [the soil's] natural function is pollutant removal which is what we're going to try to achieve a credit for."

## The Market Mantra

Putting markets to work using trades among pollution sources dates from the late 1960s in economic literature. The notion's time seems to have come. Regulatory reform has gained ground in political circles with both Republicans and Democrats endorsing trading programs of various kinds. A trading plan, after all, is helping clear the air of sulfur dioxide and will have saved more than \$500 million in compliance costs by 2005. Cap and trade programs are more likely to meet environmental goals, say economists. Unlike traditional rules, which allow pollution to grow with the economy, a cap recognizes the public has a "property right" to a limited level of a pollutant.



BETTY BOYCE NASH / FEDERAL RESERVE BANK OF RICHMOND

**Mark Alling, of Virginia's Department of Environmental Quality, samples water from the James River after Hurricane Isabel.**

Trading programs typically work by setting an enforceable limit and allowing a group of dischargers to buy and sell from each other to achieve it. It's cheaper for some plants to cut pollution than others, depending on size, age, and other variables. Sources can trade among themselves and figure out how to meet water quality standards. Flexibility inherent in trading creates incentives for firms to explore alternatives as they look for the biggest bang for the buck. Dozens of nutrient trading programs already operate nationwide, two in the Fifth District (North Carolina).

Economists say there's no way a regulator can know the cheapest method of pollution control. Yet traditional command-and-control environmental policy is based on prescriptive cleanup solutions rather than incentives to find cost-effective solutions. Firms aren't willing to invest in finding cheaper ways to cut pollution unless there is a benefit from doing it. Until they make that investment, they won't know how cheaply it could be done, economists say. While it's possible to calculate the cost of equipment and operations currently in use, it's impossible to calculate what firms could do if they had incentive, according to Virginia Tech

economist Kurt Stephenson, who has written extensively on water trading.

With a trading program, the incentive to invest in new technology arises because firms now face what economists call an "opportunity cost" for pollution discharges. This cost comes from the opportunity firms have to sell the pollution allowance at a profit rather than using it. Reduce pollution, sell allowances, make money. That's opportunity. "As an economist it drives me crazy listening to people from the states saying repeatedly we know what needs to be done," Stephenson says. "But the people running the plants know their costs and they'll figure out what needs to be done." Innovation evolves quickly under a market that puts a premium on development. A requirement for air pollution scrubbers on power plants illustrates his point.

"They were expensive and unreliable and then all of a sudden with the flexibility of the sulfur dioxide program, the scrubber industry had to compete with low sulfur coal and allowances. The reliability went up and prices went down." (See Federal Reserve Bank of Richmond's *Cross Sections*, "Pollution Allowances Help Clear the Air," Winter 1996/1997.)

Under a conventional regulatory framework, where firms receive permits to limit individual discharges, the only reward for innovation is tighter standards, write Stephenson and co-authors James Boyd and Leonard Shabman of the Washington, D.C., think tank Resources for the Future. By contrast, a trading scenario encourages participants to figure out how to meet an overall goal and generate a marketable allowance.

Nonpoint sources (currently unregulated) could participate in a trading system in a variety of ways, despite difficulties measuring nutrient runoff from diffuse sources. For example, point sources could buy credits from nonpoint sources that could adopt certain strategies documented to reduce runoff. A trading program shifts regulatory resources away from engineering pollution fixes toward measuring and monitoring pollution loads, Stephenson says.

## The Tar Heel Traders

In North Carolina, a sense of urgency drove stakeholders—farmers, treatment plant operators, and environmentalists—to trading because nutrients from farms, especially livestock operations, and treatment plants were fouling waters. That, in turn, spawned fish kills, and threatened the state's tourist industry in a big way. The state declared the Tar-Pamlico River basin "nutrient sensitive," thus tightening environmental controls. Malcolm Green, of the Greenville Utilities Commission, got behind trading early on. In 1989, Green and 12 other wastewater treatment operators in the basin formed an association and funded a \$400,000 model to compute the necessary reduction levels. Cash-strapped municipalities paid up, Green remembers, because the alternative potential costs of improvements under traditional regulations would have cost much more.

"We went to the 30 percent basin-wide reduction goal [from 1989 levels]. No one plant had a goal." The state agreed to treat the group as one. The association was assigned a fixed number of allowances, with enforceable penalties for failure to meet the cap. The association allocated allowances among its members, with freedom to trade among themselves. The association hired a consultant for advice on how to tweak plant operations for efficiency. The results surprised everyone. "We got 80 percent of the reduction number just by hiring this person."

Green says the association has traded some with farmers in the basin to ensure the success of the program but reports that most trades occur within the association. "We got so good at it, we never had to do a lot of point to non-point but we have done it... What we have done is bought credits by paying farmers to do some reductions," he says. In the trading program's second phase, basin farmers collectively are required to cut nitrogen by 30 percent by 2006 through conservation practices.

Working out the science and economics of trading is tough enough but getting people to buy in is tougher. Environmentalists, for example, tend to distrust market programs because

they figure the profit motive helped pollute the waters in the first place. David McNaught, a policy analyst with the environmental advocacy organization N.C. Environmental Defense, was executive director of the Pamlico-Tar River Foundation when the agreement was under negotiation. Environmentalists believe the cap was set too high and that the plan's omission of non-point source participation in its first phase was a mistake, he says. Yet compromise was critical for cleanup. Environmental Defense has gained a reputation for seeking out market solutions because the group wants results.

"They knew we weren't likely to solve water quality woes with taking hard line regulatory approaches," McNaught says. "We needed affirmative approaches people in the business community

would embrace." The Tar-Pam program is proving resilient after almost 15 years, but the plan is up for renewal this year and the environmental community will be watching and working to see non-point pollution sources comply, according to McNaught.

Green says the state remains hands off unless the association busts its cap. As plants expand, as have two-thirds, they install biological nutrient removal technology. The association has hired a full-time employee for the state to work exclusively on the trading program.

"That person was a big help when we went in to sell the program to the farming community," Green says.

Stephenson says the beauty of the Tar-Pamlico program is the creativity that flourished in the absence of command and control regulation.

"They did a whole bunch of these [improvements] the regulators didn't even think of." Up until the trading strategy, none of the plants had ever operated more efficiently than they had to because, lacking incentive, they didn't know how.

Farms in the Tar-Pamlico and Neuse River (also under a trading plan) basins file management plans to show how management practices reduce by 30 percent the amount of nitrogen. They're awarded credits for each practice they introduce, such as stream buffer installation, and a committee from each county compiles reports for the state.

### Trading: Design Counts

Practitioners and economists debate the nature of a true market-based program, says environmental consultant Mark

## Trading For a Cleaner Chesapeake

Mark Alling hauls his sampling bottle out of the James River. The water looks like weak tea with some floating gunk in it as Alling transfers it to an inflatable jug for its journey to a Virginia Department of Environmental Quality lab. Alling expects the river to show the effects of Hurricane Isabel, the storm that swooped down on the Virginia and North Carolina coasts last September.

"I would expect the nutrients to be high. There's more sediment load coming down in higher flows and nutrientsglom onto the sediment flow," says Alling, a biologist who is manager of DEQ's Piedmont regional office. He explains that nitrogen and phosphorous are flushed into the river by heavy rains. Since 1984, the water on all the tributaries of the Chesapeake Bay has been sampled for nutrients as well as other signals of its condition. The numbers are crucial for determining the Chesapeake Bay states' tributary strategies. Those plans are due this spring to the Chesapeake Bay Program, a nonregulatory arm of the Environmental Protection Agency. They'll help map out states' blueprints for cutting the pollution flowing into the bay.

"It will assign responsibility to wastewater treatment plants, farmers, and so on," says Bob Rose, of the program office. The strategies will document "who's here, what they're putting in now and how low they'd have to go."

All that information could help in designing

nutrient trading plans to cut levels of nitrogen and phosphorous coming into the bay.

The Chesapeake Bay, under serious scrutiny for nearly 20 years, still absorbs an estimated 285 million pounds of nitrogen a year, down from 338 million pounds in 1985. A new, voluntary agreement, in effect until 2010, calls for 175 million pounds a year, twice the amount achieved in the previous years.

The current nitrogen level is some 500 percent more than historical levels, says Rose. "I don't know if people realize how bad that is," he says. The water quality in the Chesapeake Bay last summer even sent the crabs scurrying onshore because they couldn't breathe. Summer's warmth along with too much nitrogen and phosphorous overfeeds plants, depleting oxygen necessary to support marine life. Last summer, the bay's low-oxygen zone extended from Baltimore to the Bay Bridge. Scientists estimate that up to 25 percent of the entire volume of the bay's water suffers from low or no oxygen for much of the spring, summer, and fall.

Solving the bay's nutrient problem won't be cheap. Estimates by the Chesapeake Bay Commission put the cost at nearly \$19 billion. Environmentalists doubt that a voluntary agreement can achieve bay cleanup goals.

Rose explains that "the hope is that by 2010 we can avoid having traditional regulations. We really want the cooperative, multistate effort."

For example, Maryland, Virginia, and Pennsylvania farmers file "nutrient management plans" to cut runoff. (However, Maryland is the only state where the plans are mandatory.)

If the voluntary efforts fail, however, the TMDLs, legally binding caps, will kick in, with the force of permits and fines for violation.

Among myriad voluntary efforts, the Chesapeake Bay Program has also investigated trading for the bay. In a watershed the size of the Chesapeake, ranging over 64,000 square miles and parts of six states, trading will prove challenging. The guidelines, published in 2001, ruled out watershed-wide trading. "We felt it could be viably done in riverbeds," says Roy Hoagland, Virginia executive director of the Chesapeake Bay Foundation. Even that's tricky as many rivers, like the Potomac, flow through several states. Also, Hoagland wonders, given that erosion and runoff contribute heavily to the bay's degradation, how can trades be managed from point to nonpoint?

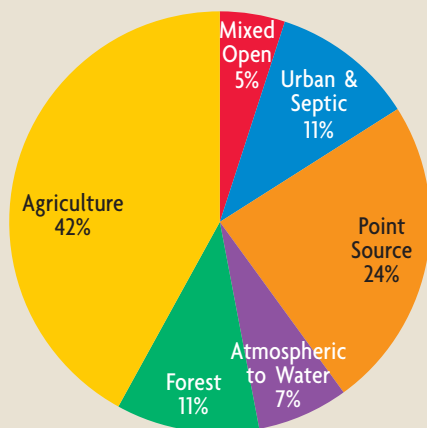
Policymakers will wrestle with such questions as states hand in tributary strategies this spring and incipient trading plans in Maryland and Pennsylvania inch forward. As Hoagland points out, trading sounds reasonable, but the devil's in the details.

"From the Bay Foundation's perspective, though, any tool that helps reduce nutrients in the bay is something we want to try," he notes.

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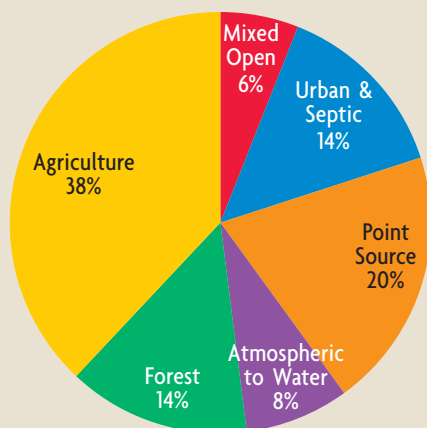


## Sources of Nitrogen Loads to the Chesapeake Bay



1985

Total Load: 358 million pounds



2000

Total Load: 305 million pounds

SOURCE: Chesapeake Bay Program

Kieser of Kieser & Associates of Kalamazoo, Mich.

"For example, look at the Connecticut-Long Island Sound program," he says. "They're looking at hundreds of millions of dollars in savings. Some might not call that a true market-based program [because] the trades are highly regulated."

Trading programs come in a wide variety of styles and sizes, some more marketwise than others. The distinction between a directive program,

where trades are dictated, and a true market approach is important, say economists.

Connecticut's trading plan, developed in 2002, is strictly regulated and applies only to wastewater treatment plants. Under the gun to reduce nitrogen 60 percent by 2014 to comply with a TMDL limit for Long Island Sound, the program put 79 plants under one permit, according to Gary Johnson. He is senior environmental engineer for the Connecticut Department of Environmental Protection. Plants were given individual permits, too. "The way the trading program works, if you do better than the numbers on your permit, you then had credits to sell," he explains. "If you didn't do as well as prescribed in [your] permit you had to purchase credits." To oversee the sale and purchase of credits, the legislature created a nitrogen credit advisory board.

Johnson says the program is cutting nitrogen ahead of projections. Some 25 of 79 plants have made capital improvements. The rest are in the throes of engineering studies to figure cost estimates.

Plants weigh the economics of buying credits versus making improvements. For a community that's just built a new high school, purchasing credits might delay a huge capital expenditure for a few years.

"We have them look at the economics of it. What would happen if we make a modest improvement now versus a significant improvement now?" Johnson says. "If you can imagine taking 79 treatment plants to the highest level of treatment – if someone can get themselves two-thirds of the way there, and purchase credits for the difference, that can save a lot of money." At the end of the year, the board sets a value for a credit and the state offers to buy excess credits.

Although Connecticut's trading plan is a cap and trade, it's not a pure market, says Dave Batchelor, who is a senior policy adviser in EPA's water office. "It's a highly managed regulatory market, but it did capitalize on economies of scale and it demonstrates how markets provide incentive for early reductions."

The way economists see it, the truer to a market a trading plan, the more potential it has for achieving water quality goals better, cheaper, and faster. And as pollution loads are quantified under EPA's daily load limits, water quality regulation is moving in the direction of cap and trade programs. Such plans, however, require watershed assessment, monitoring, and enforcement tools to guard environmental quality and preserve flexibility, according to Shabman, et al.

More trading plans are emerging as treatment plant operators prepare for the maximum pollution limits (TMDLs). In the Fifth District, the Maryland Association of Municipal Wastewater Agencies (MAMWA) hopes to implement a trading plan, according to Cy Jones, of the Washington Suburban Sanitary Commission. Using the Tar Pamlico, Neuse, and Long Island plans for inspiration, Jones says the group culled the best from each. The proposal would create four trading associations in Maryland river basins, with each receiving an overall allocation for the plants in its basin. Allowing plants to share the burden and trade among themselves uses economies of scale, Jones observes.

"Upgrading large plants but not small plants [makes sense] because you don't get much in the way of nitrogen reduction when you spend money to upgrade a two-million-gallon-a-day plant as opposed to a 30-million-gallon-a-day plant. The small plant helps fund the large treatment plant."

Eventually, MAMWA's as well as other trading plans will have to work with nonpoint sources. And that's no easy task, given historical reluctance to regulate nonpoint sources and the difficulty assessing pollution where there's no pipe.

MAMWA aims to go directly to farmers to state the case for trading. "Farmers are skeptical of trading. They say it's a way for wastewater treatment plants to avoid their own responsibilities. We want to dispel that misconception. [We'll] see what comes of that and maybe even execute some sample trades to demonstrate that all three parties, wastewater treatment plants,

farmers and the Bay can all be winners if we do these trades properly.”

### Trading and Agriculture

Farmers in Virginia’s Colonial Soil and Water Conservation District believe that, too, according to Brian Noyes and Jim Wallace. That’s why they advertise no-till farming, which is part of a program called innovative cropping systems (ICS), a set of conservation practices the farmers in their district have helped pioneer. ICS includes spoon-feeding crops with nutrients to make sure excessive fertilizer is kept off the fields (and, by extension, out of the waters).

“On a wheat crop that probably needs 125 to 140 pounds per acre of nitrogen, they will make four applications of nutrients as opposed to putting it out there at one time,” Wallace explains. “The farmers are also taking tissue tests to figure how much is in the plants and how much it needs.” New technology can detect chlorophyll in plants and signal to a sprayer an appropriate ration. Pretty neat, but expensive. “Research has shown a reduction of 30 percent to 40 percent nitrogen. That means you’re saving on your input costs.”

For 30 years, some farmers in the area, east of Interstate 95, have planted no-till soybeans and most have stopped tilling for other crop rotations, too. “So, our farmers have employed this practice where they never have to till the soil,” Wallace says, saving fuel and money and time. It benefits the farmer and the soil, which is loaded with organic matter. The soil then performs a natural function of storing pollutants such as carbon (a factor in global warming) and nutrients.

What the farmers would like is payment for this storage. “We feel like we can show the farmers are able to reduce pollutants entering waterway by employing this practice. And that should generate a tradable credit. Farmers get a shot in the arm—a fiscal shot in the arm.

“We have been talking about trading in one form or another for about three years,” Wallace says. “So we started looking at nutrient reductions that would be achieved through using

ICS. We find ourselves in the lower James watershed with multiple point source dischargers, wastewater treatment plants, 20 percent of the state’s population, military bases, industrial, and so on with Chesapeake Bay goals and tributary strategies, and looming over our heads the TMDLs,” he explains. It might be cheaper for pollution sources to pay his farmers for credits than it would be for them to reduce the pollution.

Wallace credits district farmers such as Black with a progressive streak. “They’re always looking to see how they can become more efficient.”

But while farmers in the Colonial Soil and Water Conservation District might be tending the heck out of soil in their own back yards, that’s not true everywhere. For example, poultry waste from West Virginia to the Delmarva Peninsula affects water quality as does manure from hog farming in North Carolina. Millions of tons must be managed daily to keep waste from polluting waterways.

And in a market-based trading program, if economists had their druthers, nonpoint sources would be capped, too. And McNaught of N.C. Environmental Defense says the health of waterways depends on “the elephant in the room,” nonpoint pollution.

In fact, the Tar-Pamlico and Neuse River plans do limit farm runoff, says Dave Moreau, chairman of the N.C. Environmental Management Commission.

“Each of the farms in the Neuse Basin (same applies to the Tar-Pam) had to file a nutrient management plan. And they have to show by adoption of best management practices a reduction of 30 percent nitrogen from 1995 levels,” Moreau says.

Regulating agriculture is traditionally difficult, especially in states where the sector remains a big player in the economy, but it eventually came about in North Carolina. In the 1990s, the fish kills got everybody’s attention. Moreau explains: “The coastal interest began to raise all manner of Cain.”

To some extent, trading ratios can accommodate the uncertainty involved in nonpoint to point trades, says Suzie Greenhalgh, senior economist with the

World Resources Institute, a nonprofit group located in Washington, D.C.

“If you have a point source with known discharge but nonpoint sources with diffuse discharges, there’s quite a bit of uncertainty attached to that,” she notes. “If you are a point source that needs to reduce by one pound, a farmer would sell two pounds of credits for each pound...to deal with uncertainty attached to reductions coming from nonpoint source. To me that’s a very good way of dealing with it.”

The biology behind clean water is demonstrating that nonpoint sources need to be involved in pollution control. Jim Boyd of RFF writes that “the low-hanging fruit of...point-source reductions has largely been harvested.” Economists and others say trading programs are one way to keep costs low enough so that nonpoint sources can be part of the pollution solution. **RF**

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